

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

**TITLE:       CHEMICAL VAPOR DEPOSITION APPARATUS**

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**CLAIMING PRIORITY OF KOREAN PATENT APPLICATION NO. 2003-0023398  
FILED APRIL 14, 2003**

**EXPRESS MAIL LABEL NO.  
EV 302 216 405 US**

**PATENT SPECIFICATION TITLE PAGE**

# CHEMICAL VAPOR DEPOSITION APPARATUS

## BACKGROUND OF THE INVENTION

### (a) Field of the Invention

The present invention relates to a chemical vapor deposition apparatus.

### 5 (b) Description of the Related Art

Chemical vapor deposition (CVD) forms a thin film on a substrate by the reaction of vapor phase chemicals (reactants) that contain the required constituents. The reactant gases are introduced into a reaction chamber and decomposed and reacted at a heated surface of the substrate to form the thin film. A wide variety of  
10 thin films utilized in a manufacturing process of a semiconductor device such as a thin film transistor (TFT) liquid crystal display (LCD) is prepared by CVD.

A CVD system includes a diffuser for evenly distributing the reactant gases over a substrate. The diffuser is made of metal to serve as a powered electrode, and it is combined with a diffuser frame serving as an electrode extension by bolts. Since  
15 there is a gap between the diffuser and the diffuser frame, an arc may be generated in the gap when the diffuser 70 is supplied with high radio frequency power. The arc may remove oxide such as  $\text{Al}_2\text{O}_3$  coated on the diffuser and the diffuser frame, and the metal forming the diffuser may be melted to be dropped on the substrate. The dropped metal component generates splash defect to reduce the quality of deposited  
20 thin films.

In addition, since the bolts for combining the diffuser and the diffuser frame make gaps with the diffuser and the diffuser frame, arc generation may be also made in the gaps. Accordingly, several particles are separated from the bolts to cause defects.

## 25 SUMMARY OF THE INVENTION

A chemical vapor deposition apparatus according to an aspect of the present invention is provided, which includes: a chamber having an inner space; a gas feed member for supplying a gas into the chamber; a susceptor disposed in the chamber and supporting a substrate; a diffuser partitioning the inner space of the chamber into  
30 first and second partitions and having a plurality of holes connecting the first partition and the second partition for gas communication; and an insulating frame disposed

between the chamber and the diffuser, wherein the diffuser includes an extension overlapping a surface of the insulating frame.

A chemical vapor deposition apparatus according to an aspect of the present invention is provided, which includes: a chamber having an inner space; a gas feed member for supplying a gas into the chamber; a susceptor disposed in the chamber and supporting a substrate; a diffuser partitioning the inner space of the chamber into first and second partitions and having a plurality of holes connecting the first partition and the second partition for gas communication; a diffuser frame incorporated into the diffuser; and an insulating frame disposed between the chamber and the diffuser.

The extension of the diffuser may have an "L" shape.

The diffuser may include Al or stainless steel, the insulating frame may include ceramic, and/or the substrate comprises glass. The substrate may be prepared for a liquid crystal display.

The apparatus may further include a blocking member for mixing and spreading the gas from the gas feed member before the gas passes through the holes of the diffuser.

Preferably, the diffuser is electrically powered and the susceptor is electrically grounded.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

The present invention will become more apparent by describing embodiments thereof in detail with reference to the accompanying drawings in which:

Fig. 1 is a schematic diagram of a CVD apparatus according to an embodiment of the present invention;

Fig. 2 is an enlarged view of a diffuser according to an embodiment of the present invention; and

Fig. 3 is a top view of the diffuser shown in Fig. 2.

#### **DETAILED DESCRIPTION OF EMBODIMENTS**

The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. The present invention may, however, be embodied in many

different forms and should not be construed as limited to the embodiments set forth herein.

Fig. 1 is a schematic diagram of a CVD apparatus according to an embodiment of the present invention.

5 Referring to Fig. 1, a CVD apparatus according to an embodiment of the present invention includes a reaction chamber (or reactor) 100 defining a reaction space where a thin film is formed by reactant gases.

The chamber 100 includes a chamber body 10 and a chamber lid 20. The chamber lid 20 defines an upper limit of the reaction space and the chamber body 10 defines a lower limit of the reaction space. A seal 30 such as an O-ring seal is disposed at a circumferential interface of the chamber body 10 and the chamber lid 20 for effectively isolating the reaction space from external circumstance.

A slot valve (or a slit valve) 60 is formed at a sidewall of the chamber body 10. A substrate 50 such as transparent glass for an LCD is moved from a load-lock unit (not shown) into the chamber body 10 through the opened slot valve 60.

A susceptor 40 for supporting the substrate 50 is provided in the chamber body 10. The susceptor 40 is movable up and down on a susceptor moving member such as an elevator shaft 45 to move the substrate 50 up and down. The susceptor 40 may include a heater (not shown) therein for heating the substrate 50 disposed thereon.

20 A gas feed line 400 for supplying gases are connected to an inhalation conduit 80a for delivering the gases into the chamber 100.

A blocking member (or a backing member) 90 is located in front of the inhalation conduit 80a, and a diffuser 70 is disposed below the blocking member 90 with being spaced apart from the blocking member 90 by a predetermined distance.

25 The blocking member 90 supports the diffuser 70 and it may include a conductive material such as a metal for delivering RF power into the diffuser 70. The blocking member 90 includes a spreader 90a such that the reactant gases entering from the conduit 80a strikes the spreader 90a to be sufficiently mixed in the blocking member 90 and they rotate around the spreader 90a to reach the periphery of the  
30 diffuser 70.

The diffuser 70 distributes the reactant gases uniformly over the substrate 50 through a plurality of holes 70a formed therethrough. Gaseous by-products are exhausted together with unused reactant gases through an exhaust conduit 80b.

5 The diffuser 70 is connected to a radio-frequency (RF) power generator 200 to serve as a powered electrode, while the susceptor 40 is grounded to serve as a grounded electrode. In detail, the power generated by RF generator 200 is tuned by a RF match 300, transported to the diffuser 70 through the blocking member 90 through the inhalation conduit 80a.

10 The diffuser 70 includes a conductor such as Al and stainless steel for playing a role of the powered electrode. The metallic surface of the diffuser 70 is anodized to be covered with oxide for protecting the surface from arc generated by plasma, etc.

Fig. 2 is an enlarged view of a diffuser according to an embodiment of the present invention, and Fig. 3 is a top view of the diffuser shown in Fig. 2.

15 Referring to Figs. 2 and 3, a diffuser 70 according to an embodiment of the present invention includes an electrode extension serving as a diffuser frame 70b. In other words, the diffuser frame 70b is incorporated into the diffuser 70.

The frame 70b is preferably thicker than other portions of the diffuser 70 such that the diffuser frame 70b has an "L" shape.

20 The frame 70b extends under an insulating ceramic frame 5 provided for preventing arc generation between the chamber 70 and a chamber lid 20.

The incorporation of the diffuser frame 70b and the diffuser 70 prevents particles generated by bolts for combining a diffuser frame and a diffuser separated from each other as well as splash defect due to arcs between the diffuser and the diffuser frame. Accordingly, the quality of deposited thin films is improved.

25 While the present invention has been described in detail with reference to the preferred embodiments, those skilled in the art will appreciate that various modifications and substitutions can be made thereto without departing from the spirit and scope of the present invention as set forth in the appended claims.